

Equations of motion

$$v = a t + u \quad S = u t + \frac{1}{2} a t^2 \quad v^2 = u^2 + 2 a s \quad S = \frac{(u+v)t}{2}$$

1. A tiger starts from rest and accelerates uniformly at 6 m/s^2 for 270 m. Calculate the time it takes to cover the distance.

$$S = u t + \frac{1}{2} a t^2$$

$$270 = 0 \times t + \frac{1}{2} \times 6 \times t^2$$

$$S = u t + \frac{1}{2} a t^2$$

$$90 = t^2$$

$$t = \underline{9.47 \text{ s}}$$

2. A train moving at 20 m/s brakes and decelerates uniformly at 8 m/s^2 . How much distance does it travel before coming to a stop?

$$v^2 = u^2 + 2 a s$$

$$0^2 = 20^2 + 2 \times (-8) \times s$$

$$0^2 = 400 - 16 \times s$$

$$\frac{-400}{-16} = s$$

$$s = \underline{25 \text{ m}}$$

3. A lift is at floor 2, when a woman on floor 15 presses the call button. She waited for 1 minute for the lift to arrive. Meanwhile, another man was approaching to the lift, so the woman waited for him for another 30 seconds. They then travel all the way down. It took them 80 seconds. However, a woman saw that it is raining and decided to go back for her umbrella. She waited for the lift for 30 second and then went up to floor 15 in 80 seconds. At home she changed her mind and instead of go out under the rain, she decided to stay home and watch movie. The lift can accelerate or decelerate at 0.10 m/s^2 for up to 20 seconds. Draw a sketch of the velocity-time graph of the woman in the lift. Label each part of her journey.

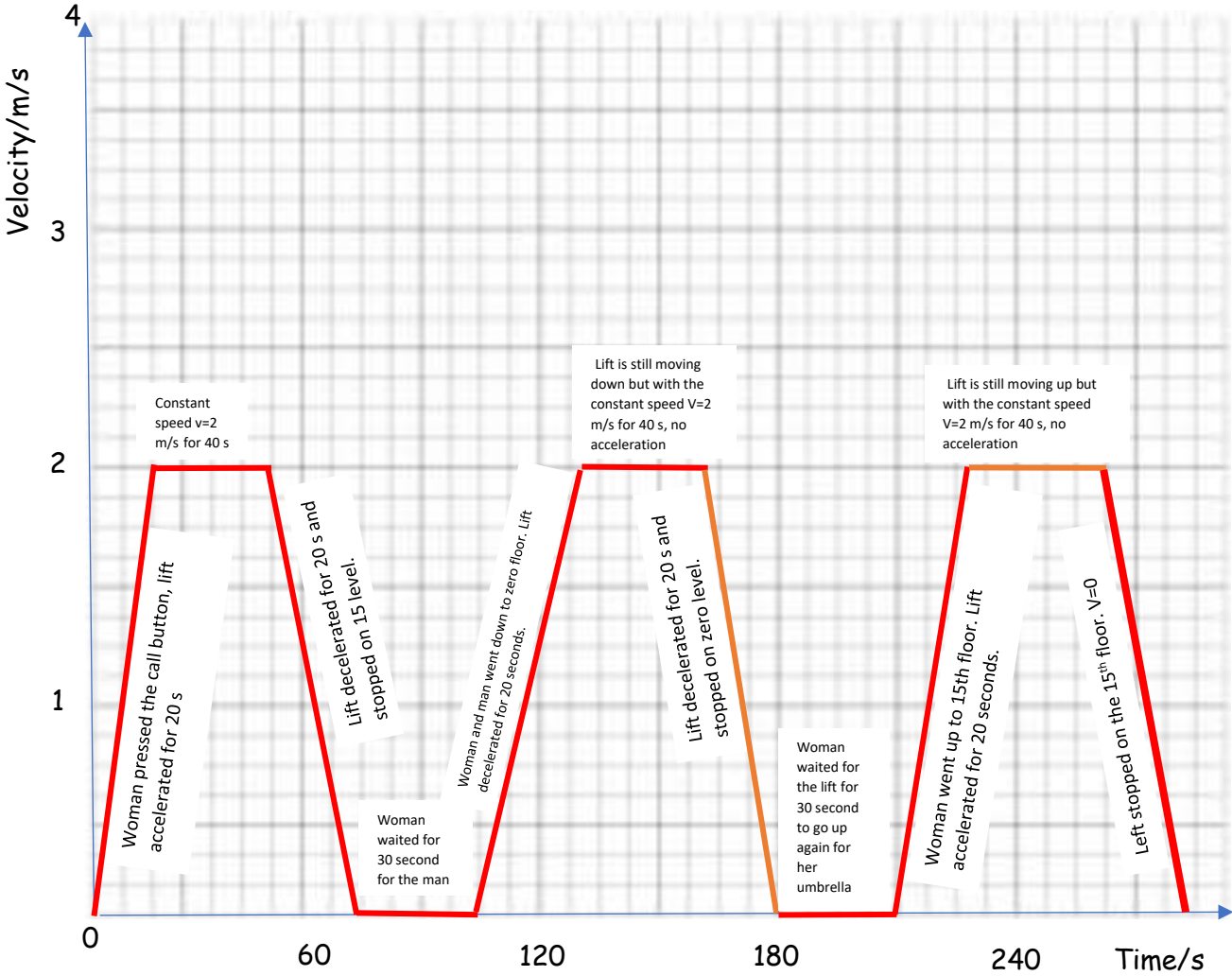
Acceleration of the lift in first 20 seconds = 0.1 m/s^2

$$a = \frac{v_f - v_i}{t}$$

$$0.1 = \frac{v_f - 0}{20}$$

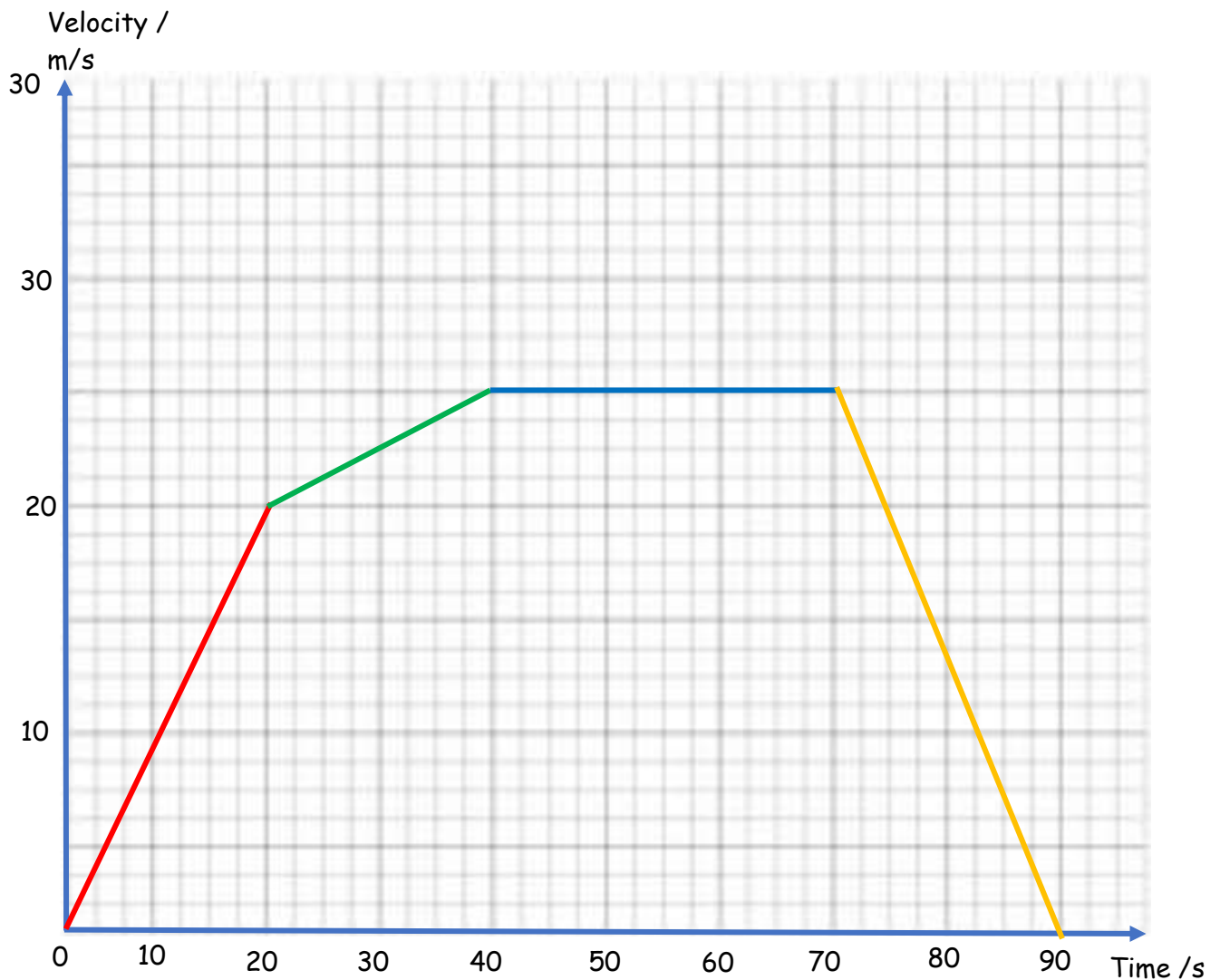
$V_f = 2 \text{ m/s}$ - the final speed of the lift

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4. On velocity-time graph showing the velocity of a car moving from starting to the finishing point. Sketch an **acceleration-time** graph for this car.



$$\text{Red part } a = \frac{v_f - v_i}{t} = \frac{20 - 0}{20} = 1 \text{ m/s}^2$$

$$\text{Green part } a = \frac{v_f - v_i}{t} = \frac{25 - 20}{20} = 0.25 \text{ m/s}^2$$

$$\text{Blue part } a = \frac{v_f - v_i}{t} = \frac{25 - 25}{30} = 0 \text{ m/s}^2$$

$$\text{Yellow part } a = \frac{v_f - v_i}{t} = \frac{0 - 25}{20} = -1.25 \text{ m/s}^2$$

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